FIG.1

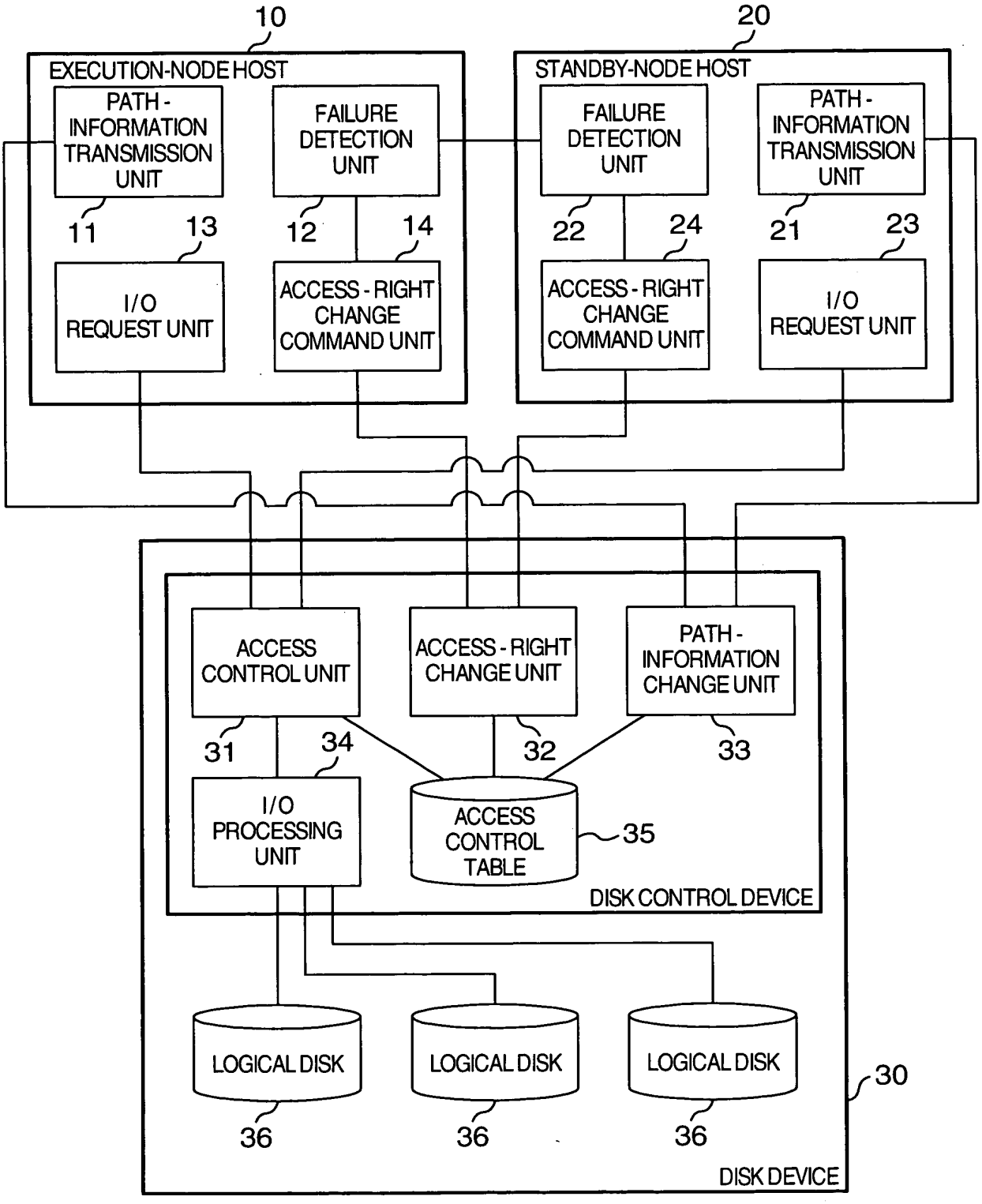
10
EXECUTION-NODE HOST
PATH - INFORMATION TRANSMISSION UNIT
FAILURE DETECTION UNIT
11
13
12
14
I/O REQUEST UNIT
ACCESS - RIGHT CHANGE COMMAND UNIT
20
STANDBY-NODE HOST
FAILURE DETECTION UNIT
PATH - INFORMATION TRANSMISSION UNIT
22
24
21
23
ACCESS - RIGHT CHANGE COMMAND UNIT
I/O REQUEST UNIT
ACCESS CONTROL UNIT
ACCESS - RIGHT CHANGE UNIT
PATH - INFORMATION CHANGE UNIT
31
34
32
33
I/O PROCESSING UNIT
ACCESS CONTROL TABLE
35
DISK CONTROL DEVICE
LOGICAL DISK
LOGICAL DISK
LOGICAL DISK
36
36
36
30
DISK DEVICE

FIG.2

ACCESS-RIGHT MANAGEMENT TABLE 35a

HOST IDENTIFICATION INFORMATION	I/O-ENABLEMENT/ DISABLEMENT	IN-PROCESSING I/O NUMBER
HOST 1	ENABLE	1
HOST 2	DISABLE	0

FIG.3

PATH-INFORMATION MANAGEMENT TABLE 35b

PATH IDENTIFICATION INFORMATION	HOST IDENTIFICATION INFORMATION
PATH 1	HOST 1
PATH 2	HOST 1
PATH 3	HOST 2
PATH 4	HOST 2

FIG.4

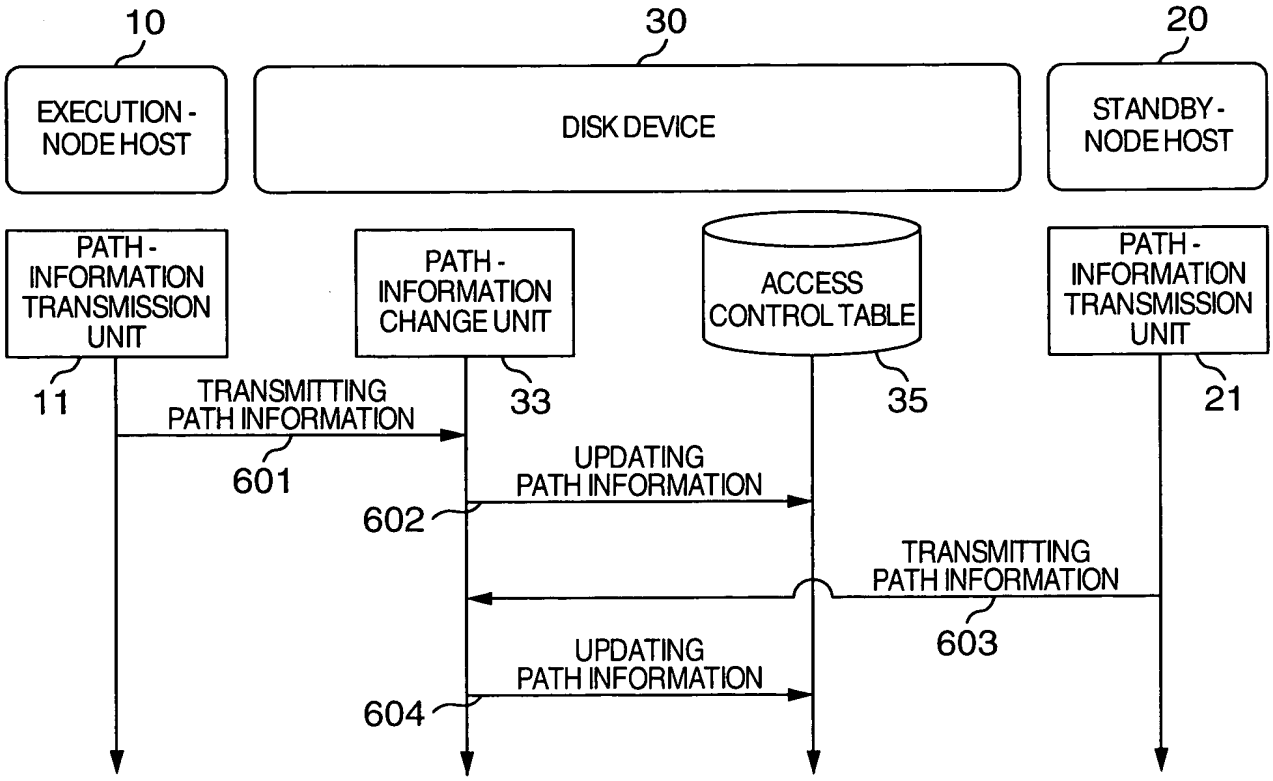

FIG.5

PATH INFORMATION 50

HOST IDENTIFICATION INFORMATION	PATH IDENTIFICATION INFORMATION	
HOST 1	PATH 1	PATH 2

FIG.6

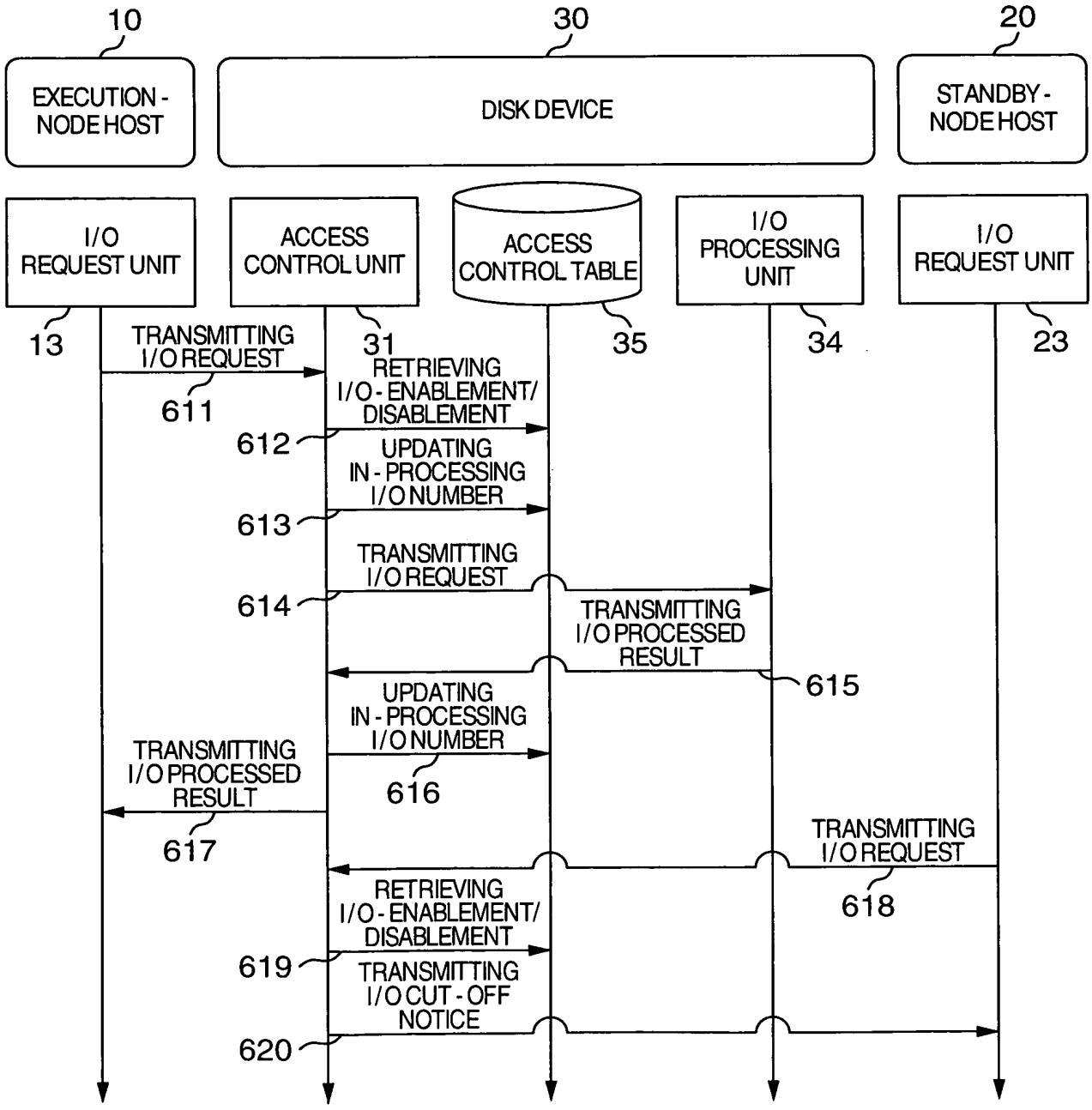

FIG.7

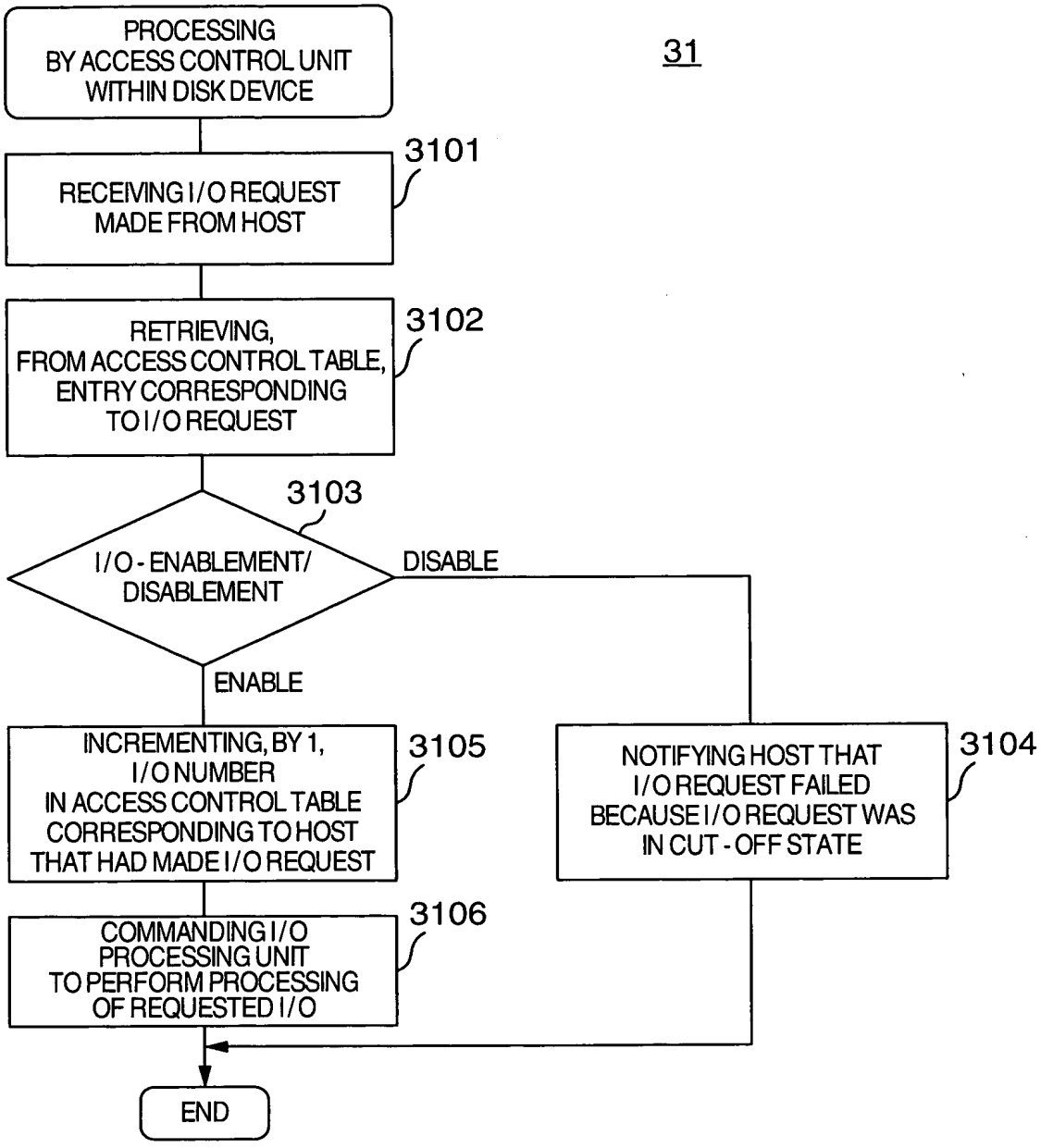
PROCESSING BY ACCESS CONTROL UNIT WITHIN DISK DEVICE
31
RECEIVING I/O REQUEST MADE FROM HOST
3101
RETRIEVING, FROM ACCESS CONTROL TABLE, ENTRY CORRESPONDING TO I/O REQUEST
3102
I/O - ENABLEMENT/ DISABLEMENT
3103
DISABLE
ENABLE
INCREMENTING, BY 1, I/O NUMBER IN ACCESS CONTROL TABLE CORRESPONDING TO HOST THAT HAD MADE I/O REQUEST
3105
NOTIFYING HOST THAT I/O REQUEST FAILED BECAUSE I/O REQUEST WAS IN CUT - OFF STATE
3104
COMMANDING I/O PROCESSING UNIT TO PERFORM PROCESSING OF REQUESTED I/O
3106
END

FIG.8

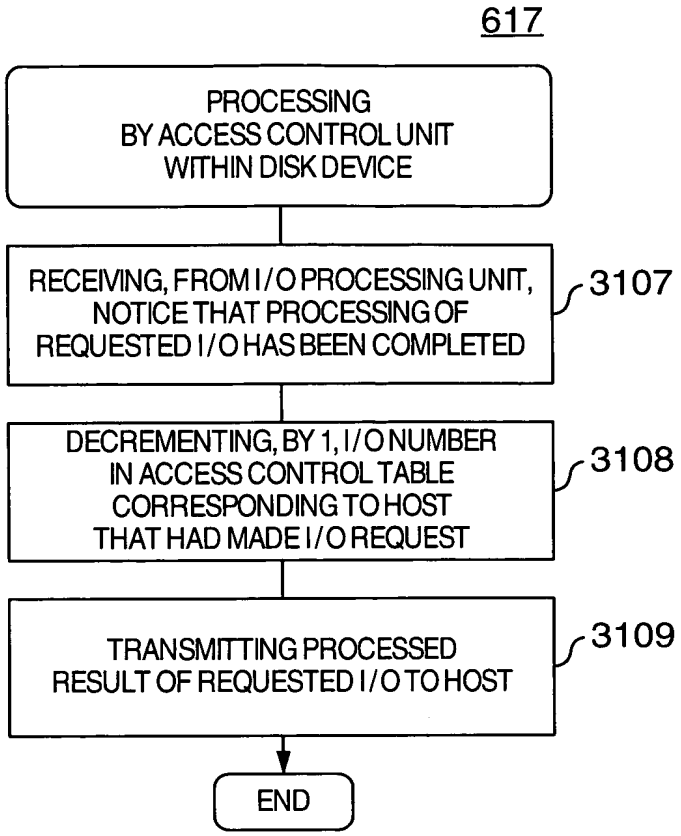
617
PROCESSING BY ACCESS CONTROL UNIT WITHIN DISK DEVICE
RECEIVING, FROM I/O PROCESSING UNIT, NOTICE THAT PROCESSING OF REQUESTED I/O HAS BEEN COMPLETED
3107
DECREMENTING, BY 1, I/O NUMBER IN ACCESS CONTROL TABLE CORRESPONDING TO HOST THAT HAD MADE I/O REQUEST
3108
TRANSMITTING PROCESSED RESULT OF REQUESTED I/O TO HOST
3109
END

FIG.9

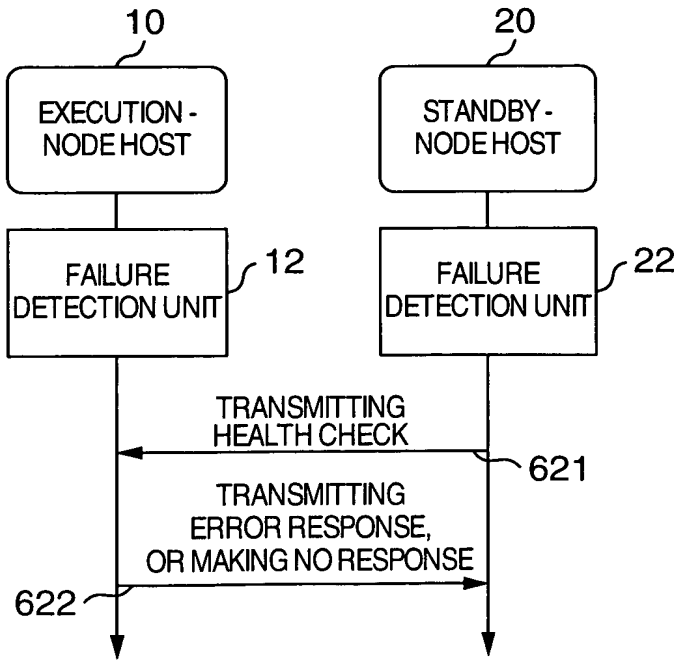
10
20
EXECUTION-NODE HOST
STANDBY-NODE HOST
FAILURE DETECTION UNIT
12
FAILURE DETECTION UNIT
22
TRANSMITTING HEALTH CHECK
621
TRANSMITTING ERROR RESPONSE, OR MAKING NO RESPONSE
622

FIG.10

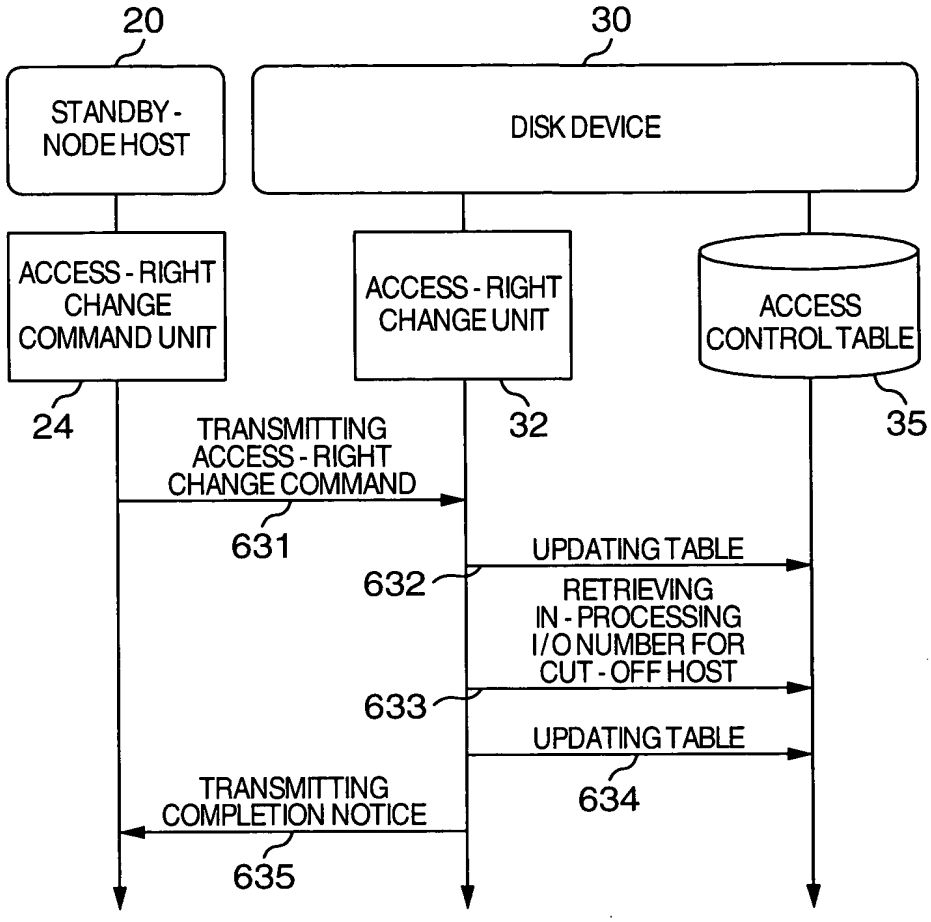

FIG.11

ACCESS-RIGHT CHANGE COMMAND 110

HOST IDENTIFICATION INFORMATION	I/O-ENABLEMENT/ DISABLEMENT
HOST 1	DISABLE
HOST 2	ENABLE

FIG.12

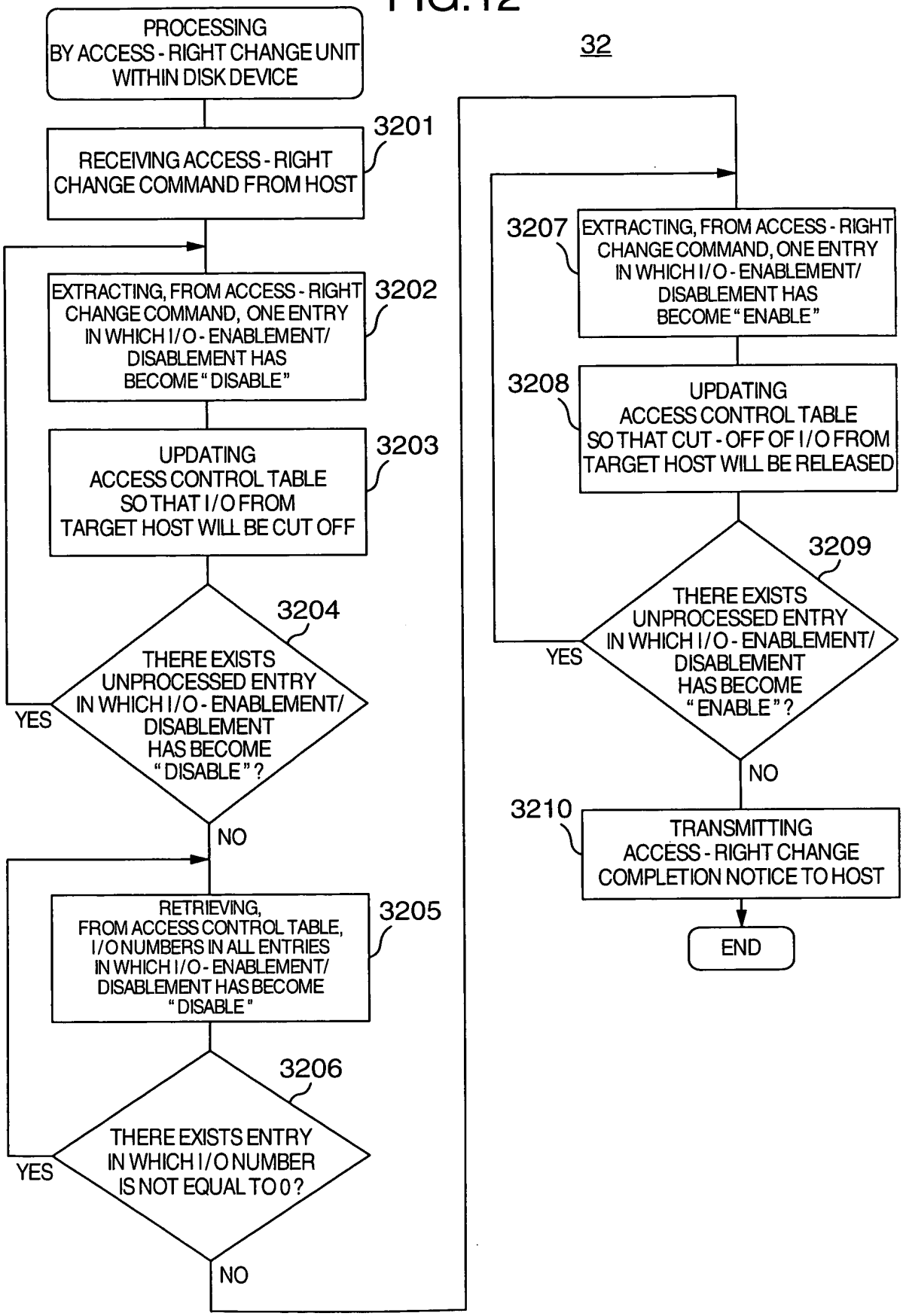
32
PROCESSING BY ACCESS - RIGHT CHANGE UNIT WITHIN DISK DEVICE
3201
RECEIVING ACCESS - RIGHT CHANGE COMMAND FROM HOST
3202
EXTRACTING, FROM ACCESS - RIGHT CHANGE COMMAND, ONE ENTRY IN WHICH I/O - ENABLEMENT/ DISABLEMENT HAS BECOME "DISABLE"
3203
UPDATING ACCESS CONTROL TABLE SO THAT I/O FROM TARGET HOST WILL BE CUT OFF
3204
THERE EXISTS UNPROCESSED ENTRY IN WHICH I/O - ENABLEMENT/ DISABLEMENT HAS BECOME "DISABLE"?
YES
NO
3205
RETRIEVING, FROM ACCESS CONTROL TABLE, I/O NUMBERS IN ALL ENTRIES IN WHICH I/O - ENABLEMENT/ DISABLEMENT HAS BECOME "DISABLE"
3206
THERE EXISTS ENTRY IN WHICH I/O NUMBER IS NOT EQUAL TO 0?
YES
NO
3207
EXTRACTING, FROM ACCESS - RIGHT CHANGE COMMAND, ONE ENTRY IN WHICH I/O - ENABLEMENT/ DISABLEMENT HAS BECOME "ENABLE"
3208
UPDATING ACCESS CONTROL TABLE SO THAT CUT - OFF OF I/O FROM TARGET HOST WILL BE RELEASED
3209
THERE EXISTS UNPROCESSED ENTRY IN WHICH I/O - ENABLEMENT/ DISABLEMENT HAS BECOME "ENABLE"?
YES
NO
3210
TRANSMITTING ACCESS - RIGHT CHANGE COMPLETION NOTICE TO HOST
END

FIG.13

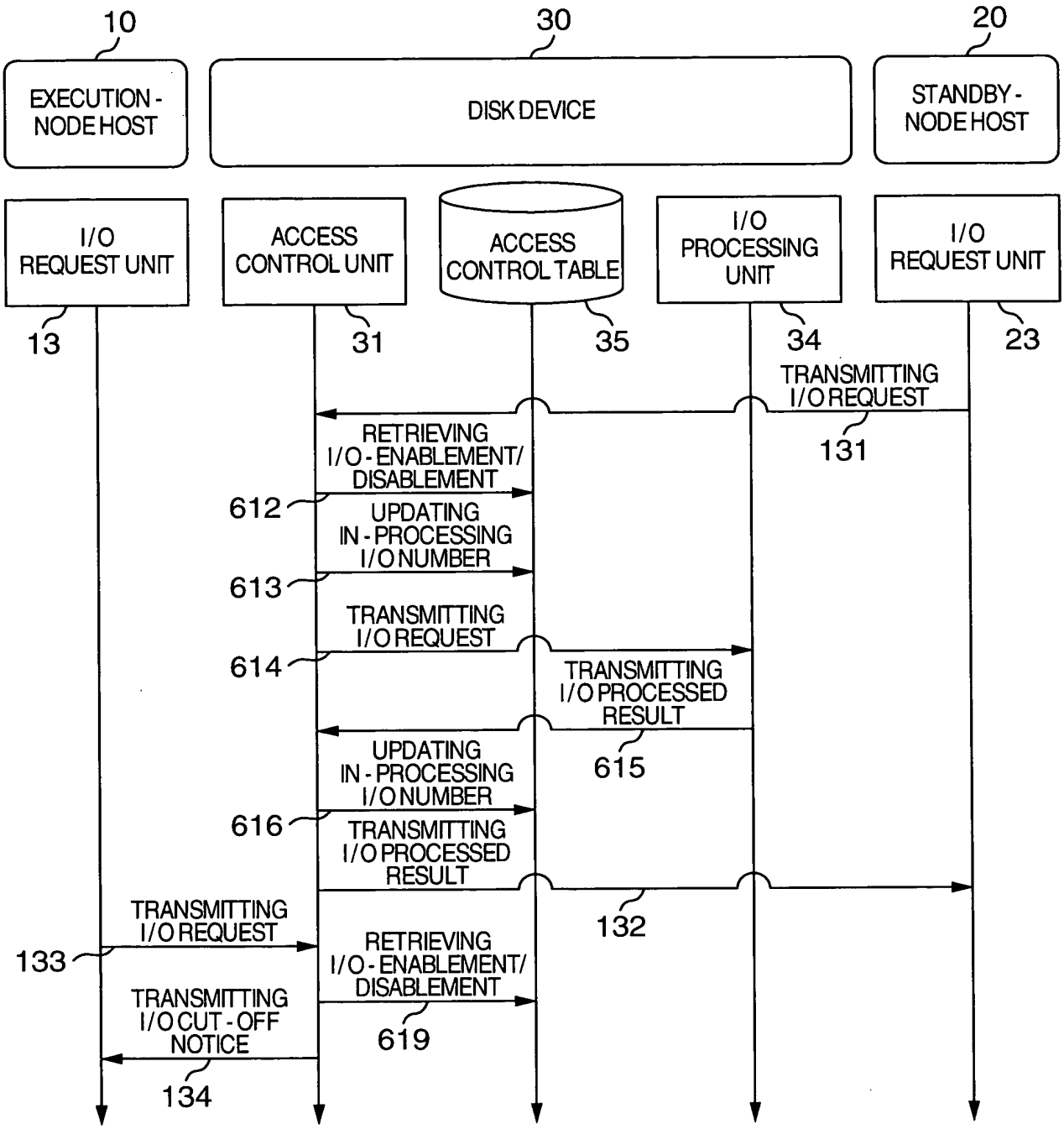
10
30
20
EXECUTION-NODE HOST
DISK DEVICE
STANDBY-NODE HOST
I/O REQUEST UNIT
ACCESS CONTROL UNIT
ACCESS CONTROL TABLE
I/O PROCESSING UNIT
I/O REQUEST UNIT
13
31
35
34
23
TRANSMITTING I/O REQUEST
131
RETRIEVING I/O-ENABLEMENT/ DISABLEMENT
612
UPDATING IN-PROCESSING I/O NUMBER
613
TRANSMITTING I/O REQUEST
614
TRANSMITTING I/O PROCESSED RESULT
615
UPDATING IN-PROCESSING I/O NUMBER
616
TRANSMITTING I/O PROCESSED RESULT
132
TRANSMITTING I/O REQUEST
133
RETRIEVING I/O-ENABLEMENT/ DISABLEMENT
619
TRANSMITTING I/O CUT-OFF NOTICE
134

FIG.14

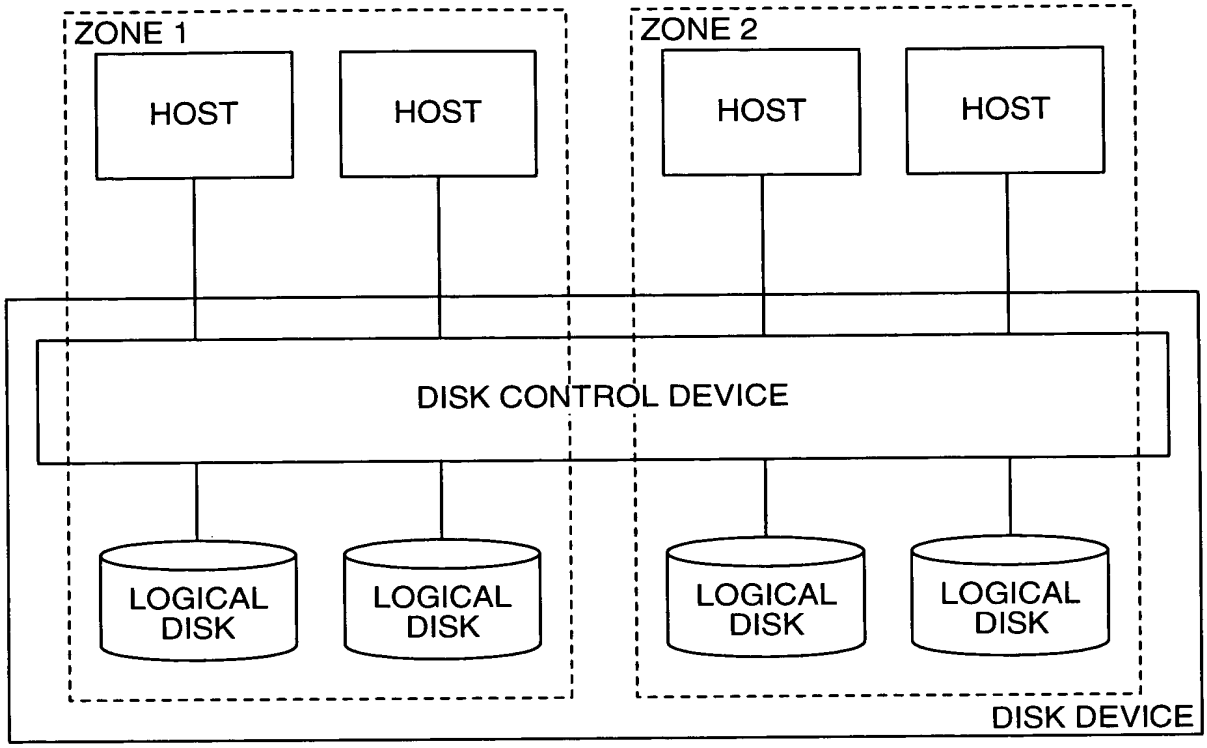
ZONE 1
ZONE 2
HOST
HOST
HOST
HOST
DISK CONTROL DEVICE
LOGICAL DISK
LOGICAL DISK
LOGICAL DISK
LOGICAL DISK
DISK DEVICE

FIG.15

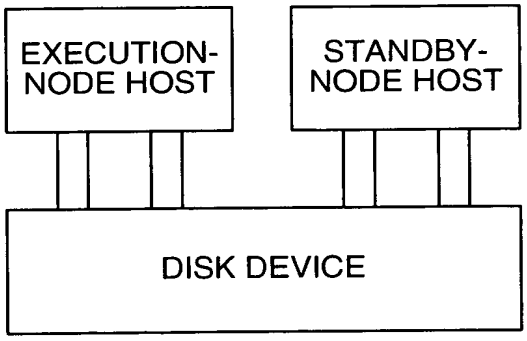
EXECUTION-NODE HOST
STANDBY-NODE HOST
DISK DEVICE

FIG.16

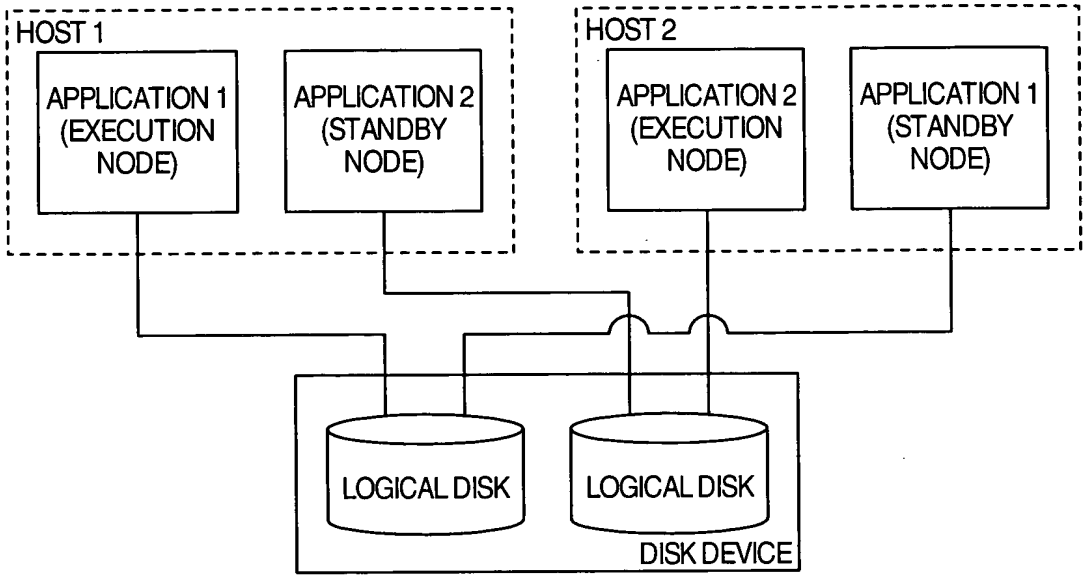
HOST 1
APPLICATION 1 (EXECUTION NODE)
APPLICATION 2 (STANDBY NODE)
HOST 2
APPLICATION 2 (EXECUTION NODE)
APPLICATION 1 (STANDBY NODE)
LOGICAL DISK
LOGICAL DISK
DISK DEVICE

FIG.17

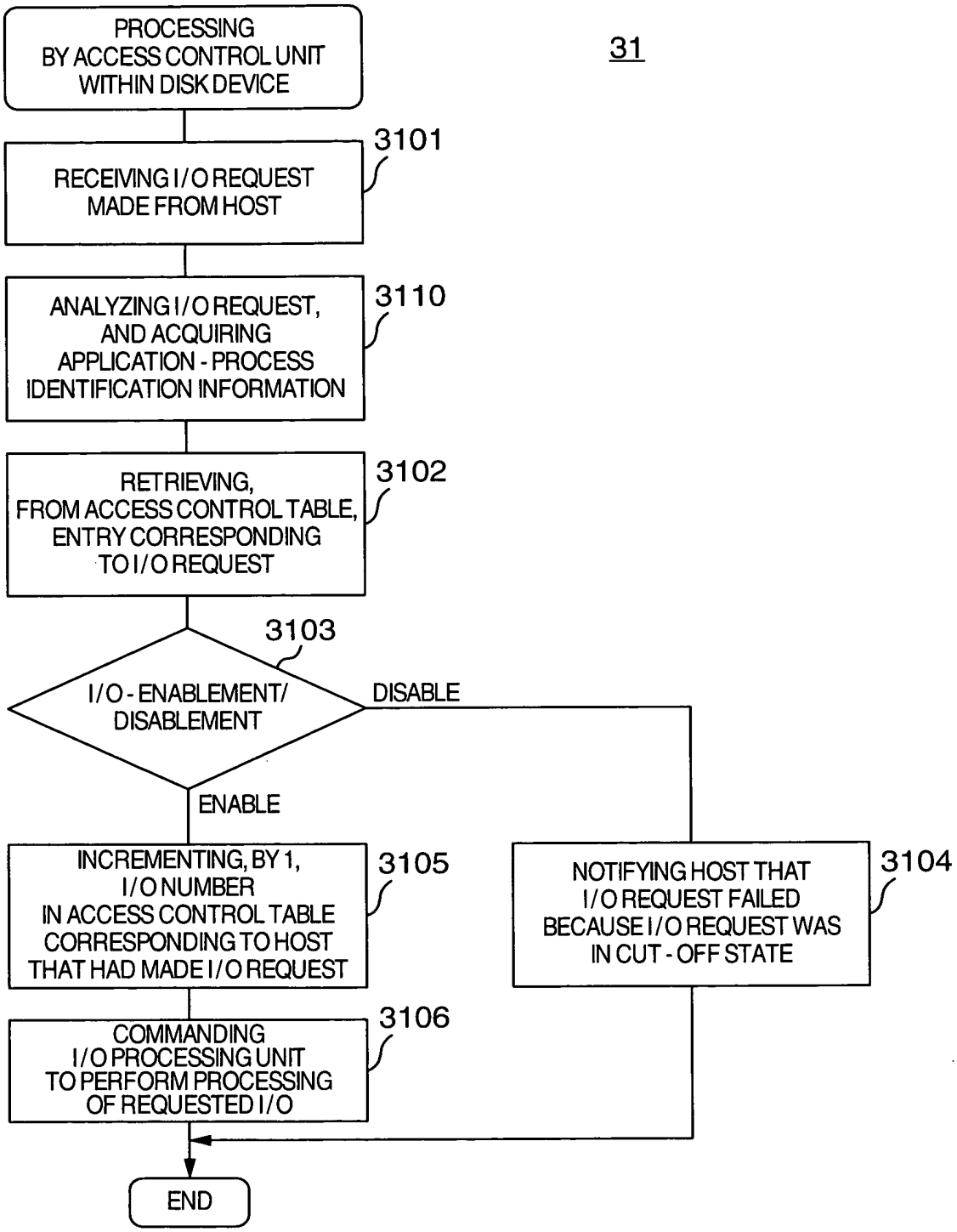
PROCESSING BY ACCESS CONTROL UNIT WITHIN DISK DEVICE
31
3101
RECEIVING I/O REQUEST MADE FROM HOST
3110
ANALYZING I/O REQUEST, AND ACQUIRING APPLICATION - PROCESS IDENTIFICATION INFORMATION
3102
RETRIEVING, FROM ACCESS CONTROL TABLE, ENTRY CORRESPONDING TO I/O REQUEST
3103
I/O - ENABLEMENT/ DISABLEMENT
DISABLE
ENABLE
INCREMENTING, BY 1, I/O NUMBER IN ACCESS CONTROL TABLE CORRESPONDING TO HOST THAT HAD MADE I/O REQUEST
3105
NOTIFYING HOST THAT I/O REQUEST FAILED BECAUSE I/O REQUEST WAS IN CUT - OFF STATE
3104
COMMANDING I/O PROCESSING UNIT TO PERFORM PROCESSING OF REQUESTED I/O
3106
END

FIG.18

35aa

ACCESS-RIGHT MANAGEMENT TABLE

LOGICAL-DISK IDENTIFICATION INFORMATION	HOST IDENTIFICATION INFORMATION	I/O-ENABLEMENT/ DISABLEMENT	IN-PROCESSING I/O NUMBER
LOGICAL DISC 1	HOST 1	ENABLE	1
LOGICAL DISC 1	HOST 2	DISABLE	0
LOGICAL DISC 2	HOST 1	DISABLE	0
LOGICAL DISC 2	HOST 2	ENABLE	3

FIG.19

110a

ACCESS-RIGHT CHANGE COMMAND

LOGICAL-DISK IDENTIFICATION INFORMATION	HOST IDENTIFICATION INFORMATION	I/O-ENABLEMENT/ DISABLEMENT
LOGICAL DISC 1	HOST 1	DISABLE
LOGICAL DISC 1	HOST 2	ENABLE
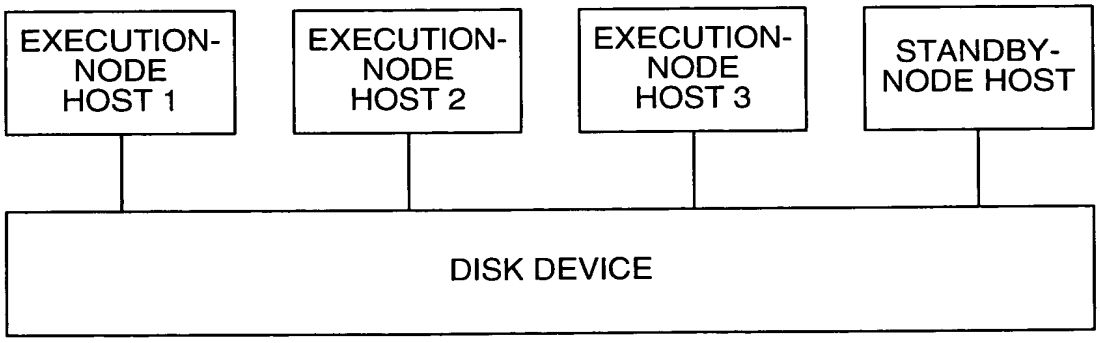
FIG.20